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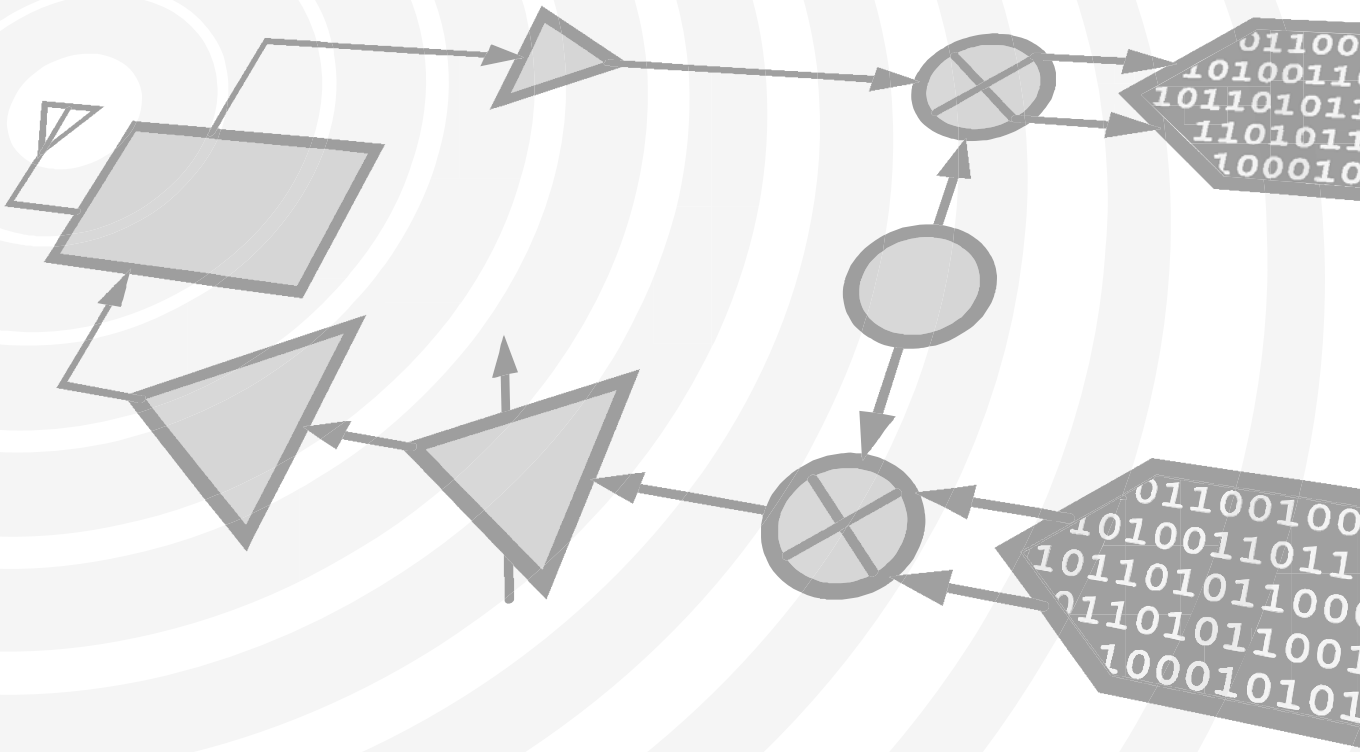

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HMC960LP4E Evaluation Kit

Analog, Digital & Mixed-Signal ICs, Modules, Subsystems & Instrumentation

User Manual

Software & Hardware Installation

Hittite MICROWAVE CORPORATION

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Notice

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1. Introduction

This document describes the usage and functionality of the HMC960LP4E I/Q Variable Gain Amplifier Filter Evaluation Kit. This kit includes PC compatible software that generates a Graphical User Interface (GUI) allowing the user to read from and write to all device registers, set gain levels and save & recall device configurations.

Note: For most up-to-date software download and information please visit www.hittite.com.

2. Package Contents

2.1 Hardware

Verify that all the items listed in Table 1 are included in the shipment.

Item	Quantity
HMC960LP4E Evaluation Board	1
USB Interface Board	1
6' USB A Male to USB B Male Cable	1
CD ROM (Contains User Manual and software)	1

Table 1: Packing List

2.2 Software

HMC960LP4E Eval Software Enables users to communicate with and control HMC960LP4E with their PCs, and observe full functionality and performance of HMC960LP4E.

3. Operating Environment

This evaluation kit is designed for use in a laboratory setting at ambient room temperature (25°C) and is not protected against moisture. The USB Interface Board has an ESD rating of +/-3000V, however the HMC960LP4E may have a lower rating (check the product's datasheet for its specific ESD rating). Use appropriate ESD procedures and precautionary measures when handling all electronic hardware.

4. Setup and Installation

4.1 User Provided Equipment

In addition to the items provided in the evaluation kit, the user must provide the following equipment to communicate with the device under test.

- DC Power Supply
- DC Cables
- Computer (PC) with Standard USB port
- Baseband differential I/Q signal source
- Baseband differential I/Q measurement equipment
- For detail specifications regarding operating system and software requirements please visit www.hittite.com

4.2 Software Installation

Note: Installing/Uninstalling the HMC960LP4E Evaluation Software requires administrative privileges

To install/uninstall HMC960LP4E Evaluation Software, double click on "HMC960LP4E Eval Software Installer.exe" that was downloaded from www.hittite.com, or provided with a CD, and follow the installation/uninstallation wizard.

4.3 Hardware Setup

Setup all hardware according fo **Figure 1.**

- Connect the USB board to HMC960LP4E eval board.
- Connect the USB cable to USB board.
- Apply +5.5V to TP1 (TP2 is GND) on HMC960LP4E eval board. Supply current should be ~70mA.
- Use a jumper on J1 to connect Vdd/2 to the HMC960LP4E output common mode control pin.

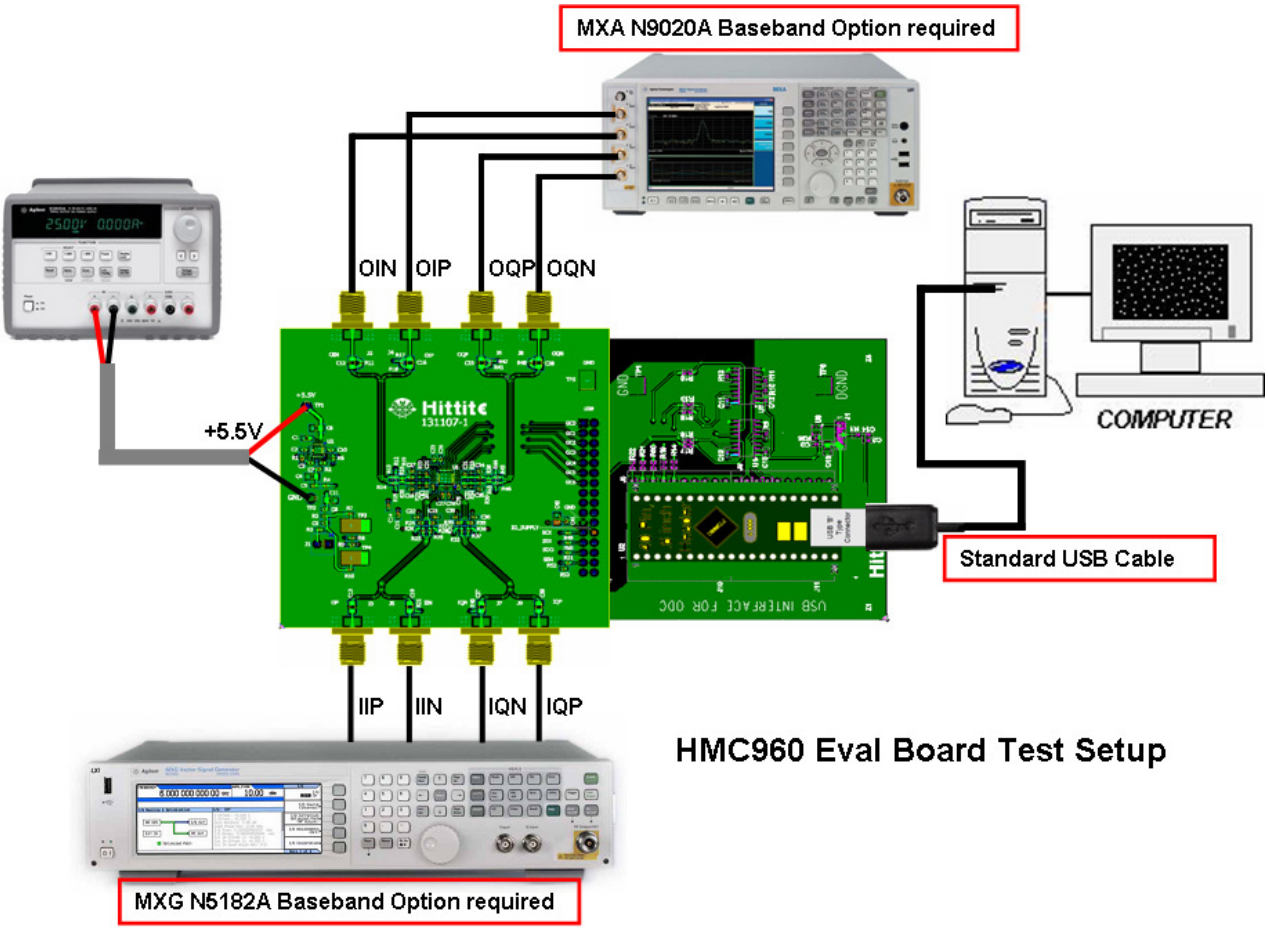

Figure 1. HMC960LP4E Eval Board Test Setup

4.4 Evaluation Board Configuration

The HMC960LP4E Evaluation Board schematic shows both differential and single-ended configurations with components required for single-ended operation labeled 'depop'.

4.4.1 Default Configuration (Differential Inputs/Outputs)

The HMC960LP4E Evaluation Board is shipped configured for differential operation by default. Components required for single-ended operation are specified in the Evaluation Board schematic, but are not populated. Default (differential) input and output configurations are shown in **Figure 2** and **Figure 3** respectively.

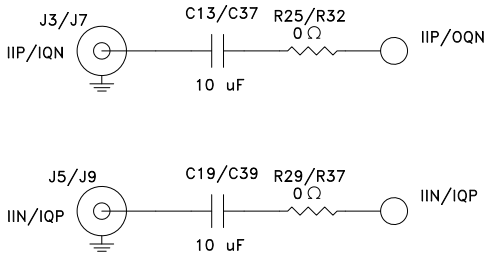

Figure 2. HMC960LP4E Evaluation Board Default Differential Input Configuration

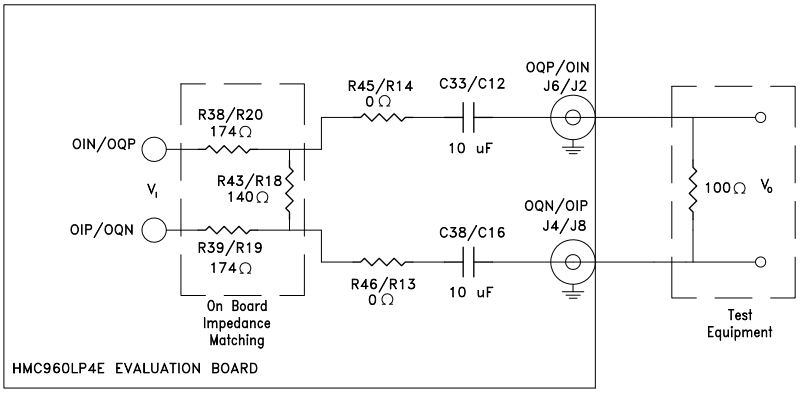

Figure 3. HMC960LP4E Evaluation Board Default Differential Output Configuration

4.4.2 Single-Ended Inputs/Outputs Configuration

Hardware board changes are required to configure the HMC960LP4E Evaluation Board for single-ended operation

4.4.3 Single-Ended Input Configuration

To configure the HMC960LP4E Evaluation Board for single-ended input operation, 0 Ω resistors R25, R29, R32, R37 need to be removed, and the following components need to be populated:

- 0 Ω resistors, R21, R40, R26, R31, R28, R36
- 10 µF capacitors, C44, C45
- and two ADT2-1T Baluns (T3 & T4)

Note that the components required for single-ended input configuration are not included in the HMC960LP4E Evaluation Kit:

Single-ended input configuration of the HMC960LP4E is shown in **Figure 4**.

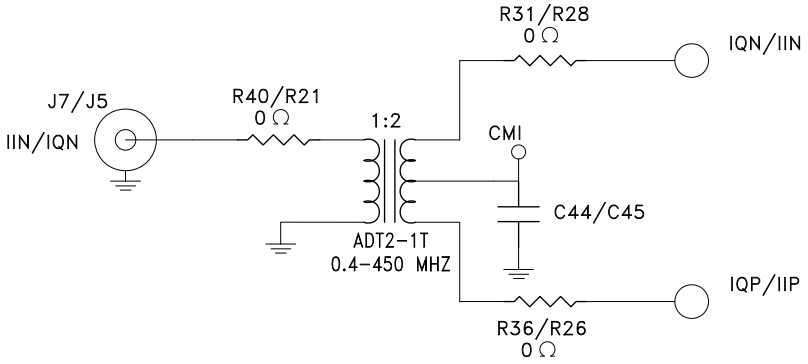

Figure 4. HMC960LP4E Evaluation Board Single-Ended Input Configuration

4.4.3.1 Single-Ended Output Configuration

To configure the HMC960LP4E Evaluation Board for single-ended output operation, 0 Ω resistors R14, R13, R45, R46 need to be removed, and the following components need to be populated:

- 0 Ω resistors, R15, R12, R44, R47, R17, R42
- 10 µF capacitors, C42, C43
- and two ADT2-1T Baluns (T1 & T2)

Note that the components required for single-ended output configuration are not included in the HMC960LP4E Evaluation Kit:

Single-ended output configuration of the HMC960LP4E is shown in **Figure 5**.

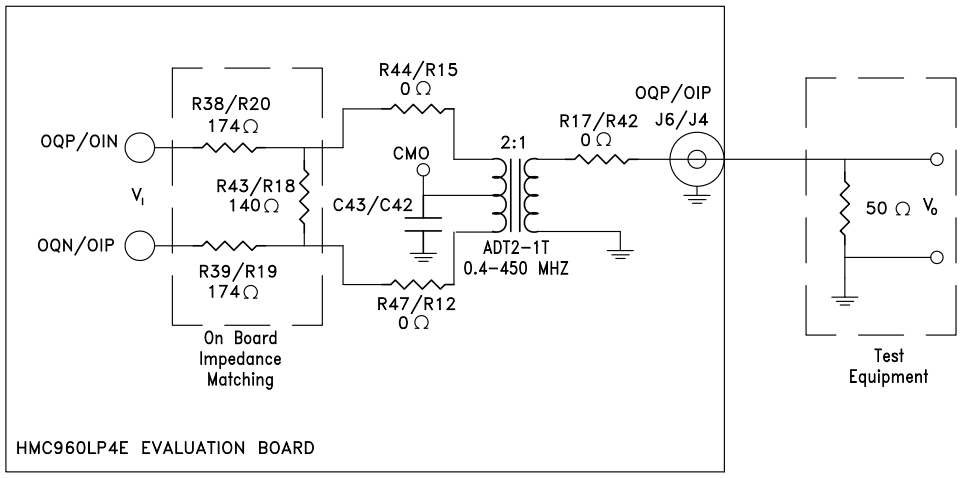

Figure 5. HMC960LP4E Evaluation Board Single-Ended Output Configuration

4.5 HMC960LP4E Evaluation Board Interface to Test Equipment

To provide seamless interface to standard off-the-shelf test equipment, the HMC960LP4E Evaluation Board has an on-board impedance matching network shown in **Figure 3** and **Figure 5** for differential and single-ended output configuration respectively.

The impedance matching network transforms HMC960LP4E's load impedance of 400 Ω differential to 100 Ω differential (50 Ω single-ended), which is common input impedance for test equipment.

When observing voltage levels out of the HMC960LP4E Evaluation Board, the impedance transformation, resulting from the matching network, needs to be considered.

The impedance transformation will result in an observed voltage drop of ≈ 16.8 dB ($V_o = V_I + 20\log\left(\frac{140\Omega\,//\,100\Omega}{140\Omega\,//\,100\Omega + 174\Omega + 174\Omega}\right) = V_I - 16.8\,dB$) using differential setup. Single-ended

operation will result in additional 3 dB voltage loss (19.8 dB total voltage loss) due to the 2:1 balun turns ratio.

5. Using the HMC960LP4E Evaluation Software

1. Launch HMC960LP4E Evaluation Software by selecting on "Hittite BBVGA Eval Software V10xx.exe" from the Program Files menu of your computer. The main window should open. See **Figure 6** below.

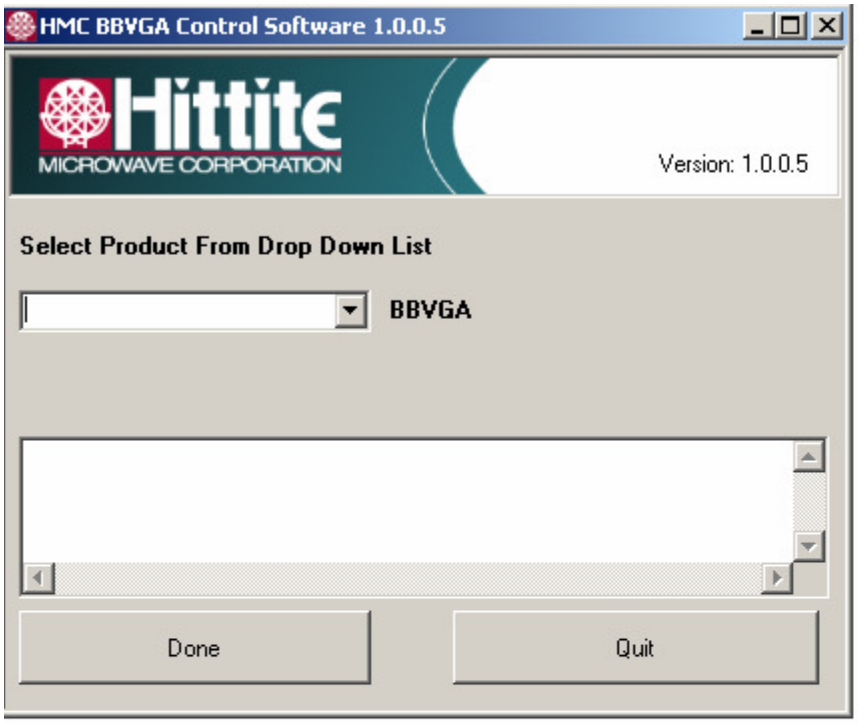

Figure 6. HMC BBVGA Control Software

2. From this window select the HMC960LP4E from the drop down menu and press “Done” and the following window appears.

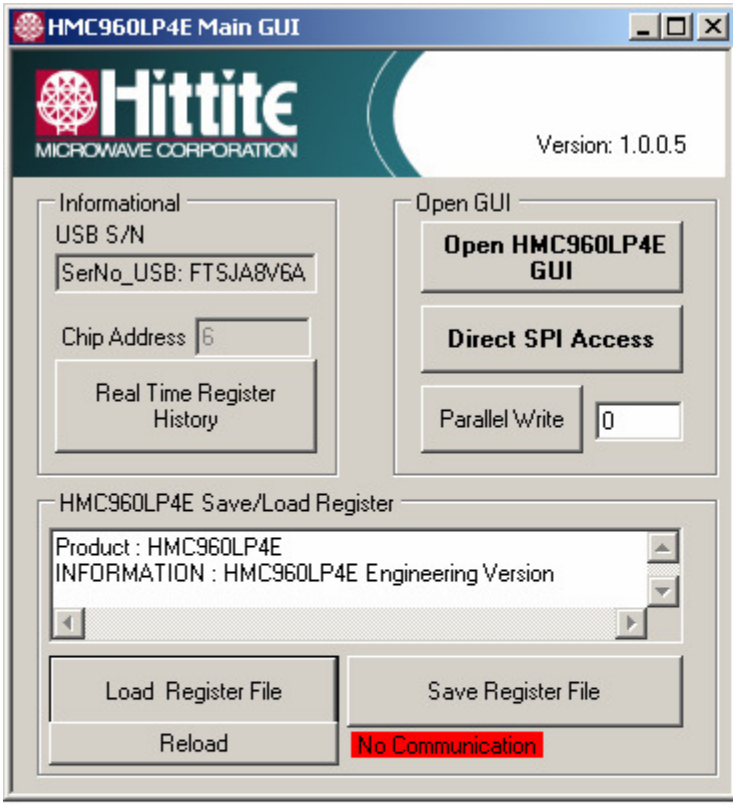

Figure 7. HMC960LP4E Main GUI

5.1 HMC960LP4E GUI

The HMC960LP4E GUI allows the user to quickly:

- Enable/disable the HMC960LP4E I or Q path.
- Set the op-amp and/or driver bias.
- Set the input impedance.
- Set the VGA gain through the SPI (Reg02 bit 5 must be set to control the VGA gain via the SPI).
- Increment the gain step up or down as desired.

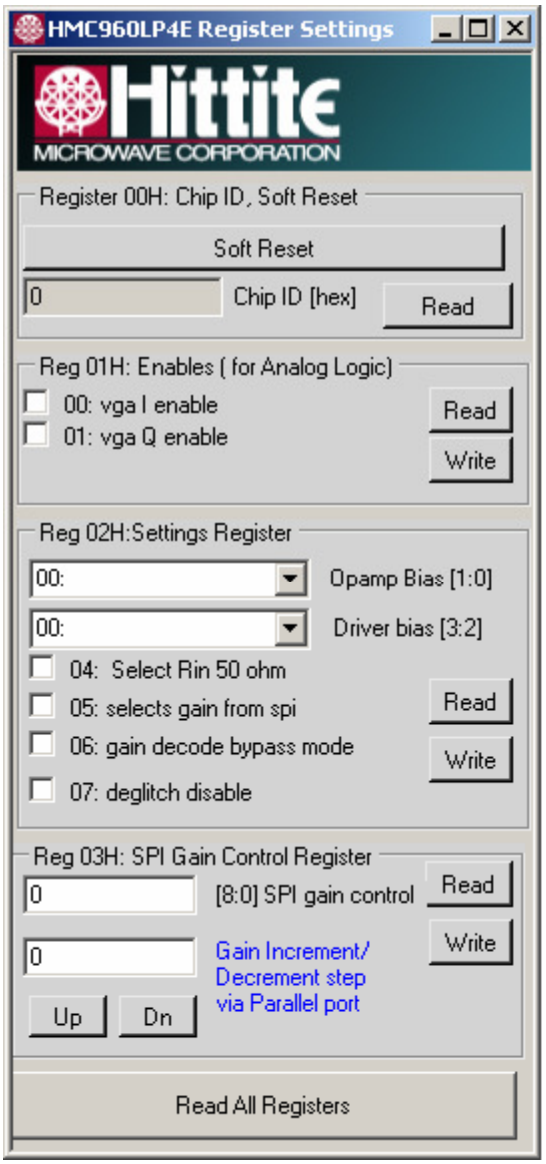

Figure 8. Register Settings

- Enabling I and/or Q channel is accomplished by checking the appropriate box and writing the register.
- Setting baseband gain through the SPI is accomplished by setting Reg02h bit 5 to “1” and programming the desired gain in Reg03h. Note that the gain control value programmed represents a 0.5dB gain such that a setting of “40” would represent 20dB gain.
- The gain can be incremented or decremented by a user programmable amount (“Gain Increment/Decrement”) and activated by the “Up” and “Dn” buttons.
- Each register is controlled by its own “Read” and “Write” button in its sub-panel. If you click on any check box the action is only implemented when you push that register’s “Write” button. Similarly a panel is only updated when you push the “Read” button.

5.2 Direct Register Access

- "Direct SPI Access" button provides direct register read/write capability in Hex. These are debug tools only.

5.3 Parallel Write

- The Parallel Write function allows the user to control the gain of the HMC960LP4E via the parallel port control on the device. Note, this is only supported with a parallel port USB, which will generally not be provided with the HMC960LP4E evaluation kit, thus SPI gain control would be used. Refer to attached datasheet for further information on parallel control of the HMC960LP4E.

5.4 Save or Load Complete Register Files

- To open an existing register configuration file use the "Load Register File" button.
- To save a register configuration to a file use the "Save Register File" button. This allows you to instantly recall the desired register state by using the " Load Register File" button.

6. Technical Support

Please contact apps-support@hittite.com for any questions. Hittite Microwave provides local direct support in many areas around the world. Please see the "Contact Us" page at www.hittite.com.

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